Complications of Pure Transperitoneal Laparoscopic Surgery in Urology: The Taipei Veterans General Hospital Experience

Yu-Hung Lin, Hsiao-Jen Chung*, Alex T.L. Lin, Yen-Hwa Chang, William J.S. Huang, Yen-Shen Hsu, Shyh-Chyi Chang, Kuang-Kuo Chen

Division of Urology, Department of Surgery, Taipei Veterans General Hospital, and Department of Urology, National Yang-Ming University School of Medicine, Taipei, Taiwan, R.O.C.

Background: We present our experience of complications of pure transperitoneal laparoscopic surgery in urology at Taipei Veterans General Hospital.

Methods: Between September 2003 and March 2006, 185 laparoscopic urologic operations were performed, consisting of 70 nephrectomies (36 radical, 17 partial, 11 simple, 6 donor), 28 adrenalectomies, 28 nephroureterectomies, 22 radical prostatectomies, 17 ureterolithotomies, 6 radical cystectomies, 5 pyeloplasties, 2 renal cyst unroofings, 2 nephropexies and 5 other operations. We reviewed the database of the patients to evaluate the complications and analyze factors related to laparoscopic surgeries.

Results: A total of 25 patients had 26 complications (14.1%, major in 4, minor in 22). The complications were categorized into intraoperative and postoperative complications in 10 and 16 patients, respectively. The mortality rate was 0%. The conversion rate was 0.54% (1 patient). The re-operation rate was 1.08% (2 patients). The most common intraoperative complication was vascular injury (5 patients). The incidence of complication was related to the difficulty level of operation. No statistically significant differences were found between complication rate and patient age, patient body mass index or the American Society of Anesthesiologist score.

Conclusion: The complications of laparoscopic urologic surgeries are strongly correlated with the operative difficulties. In spite of elevated complication rates in difficult surgeries, the major complication rate in this study was very low. As the laparoscopic surgeries in urology involve more and more technique-dependent difficult fields, documentation and analysis of experience of complications is important for the development of this surgical modality. [*J Chin Med Assoc* 2007;70(11):481–485]

Key Words: intraoperative complications, laparoscopy, postoperative complications, urology

Introduction

Since the first laparoscopic nephrectomy reported by Clayman et al in 1991,[1] there has been booming investigation about applications for laparoscopic surgery in urology. Laparoscopic surgery has become an alternative to almost all open surgeries in urology, such as adrenal neoplasm, benign or malignant kidney disease, and more recently prostate cancer and bladder cancer. The advantages of lower morbidity, less postoperative pain, shorter hospital stay and better cosmetic results are attracting more and more urologists into this field. Urologists have to be familiar with the complications confronted in laparoscopic surgeries. There are numerous studies reporting the experience in laparoscopic complications but such reports from Taiwan are rare. Thus, we present our experience of the complications we encountered in 185 pure transperitoneal laparoscopic surgeries.

Methods

Between September 2003 and March 2006, 185 consecutive pure transperitoneal laparoscopic operations in urology were performed at Taipei Veterans General

*Correspondence to: Dr Hsiao-Jen Chung, Division of Urology, Department of Surgery, Taipei Veterans General Hospital, 201, Section 2, Shih-Pai Road, Taipei 112, Taiwan, R.O.C.
E-mail: hjchung@vghtpe.gov.tw • Received: May 7, 2007 • Accepted: October 16, 2007

Table 1. General data of transperitoneal laparoscopic procedures*

	Patients	Sex (M/F)	Mean age, yr	Mean BMI, kg/m^2	Mean op time, hr	Mean blood loss, mL	Blood transfusions
Radical nephrectomy	36	27/9	68±15	24.5±3.7	5.2±1.9	210±309	4 (11.1)
Adrenalectomy	28	10/18	51±12	24.4±4.7	4.0±1.2	94±177	2 (7.1)
Nephroureterectomy	28	19/9	66±15	22.9±3.3	5.9±1.6	190±200	4 (14.3)
Radical prostatectomy	22	22/0	71±7	25.8±2.3	9.9±3.3	472±667	2 (9.1)
Ureterolithotomy	17	13/4	55±13	24.5±3.8	3.7±1.5	35±34	0 (0)
Partial nephrectomy	17	8/9	53±17	24.6±3.7	6.6±2.3	439±397	3 (17.6)
Simple nephrectomy	11	7/4	57±23	23.5±3.5	5.0±1.9	107±184	1 (9.1)
Donor nephrectomy	6	2/4	38±3	21.6±1.6	7.5±1.9	397±549	1 (16.7)
Radical cystectomy	6	3/3	67±11	25.9±2.9	15.0±1.7	840±441	2 (33.3)
Pyeloplasty	5	3/2	50±16	20.8±4.5	6.5±2.1	32±11	0 (0)
Others	9	6/3	50±22	22.4±2.6	4.3±2.5	49±99	0 (0)
Overall	185	128/57	60±17	24.1±3.7	6.0±2.9	226±440	19 (10.3)

**Data are expressed as n, mean ± standard deviation, or n (%).*

Hospital. The data collected included patient age, sex, body mass index (BMI), operative time, estimated blood loss (EBL), blood transfusion, the American Society of Anesthesiologists (ASA) score, length of postoperative stay (LOS), procedure type, operative difficulty and operative date. The ASA score was collected from anesthesiology records, with the following definitions: Class 1—normal healthy; Class 2—patient with mild systemic disease; Class 3—patient with severe systemic disease; Class 4—patient with severe systemic disease that is a threat to life; Class 5—morbid patient who is not expected to survive without the operation; Class 6—a declared brain-dead patient whose organs are being removed for donor purposes.

The 185 operations consisted of 70 nephrectomies (36 radical, 17 partial, 11 simple, 6 donor), 28 adrenalectomies, 28 nephroureterectomies, 22 radical prostatectomies, 17 ureterolithotomies, 6 radical cystectomies, 5 pyeloplasties, 2 renal cyst unroofings, 2 nephropexies and 5 other operations (Table 1). Kidney and adrenal surgeries were performed using modified flank position. Prostate and bladder surgeries were performed with patients in Trendelenburg's position. The medical charts were reviewed retrospectively.

Mean patient age was 60±16.5 years (range, 7–91 years). About two thirds (69.6%) of patients had an ASA score of 1 or 2, and 30.4% had a score of 3 or 4 (Table 2). There were 15.5% patients who had received previous abdominal surgery. We classified all complications into 2 categories: intraoperative (directly attributable to the operative procedure and identified at surgery) and postoperative (directly or not directly attributable to the operative procedure and identified after surgery). The severity of operative complications was classified into major—mortality, re-operation, conversion or intensive care unit stay for more than 24 hours, and minor—without mortality, re-operation, conversion or intensive care unit stay for more than 24 hours.

Operative difficulty was classified according to the European Scoring System as *extremely difficult* (radical cystectomy, radical prostatectomy and nephrectomy for donor), *very difficult* (radical nephrectomy for tumor, partial nephrectomy for tumor and retroperitoneal lymph node dissection for staging), *difficult* (nephroureterectomy, pyeloplasty and adrenalectomy > 6 cm), *fairly difficult* (nephrectomy for benign disease, adrenalectomy < 6 cm), *slightly difficult* (nephropexy, partial nephrectomy for benign disease, ureterolithotomy), and *easy* (renal cyst unroofing). [2]

The relations of complications and patient age, BMI, operative difficulty, or ASA score were analyzed. Age and BMI were analyzed as continuous variables. Statistical analyses were performed with Fisher's exact test, 2-sample *t* test, and single and multiple logistic regression using SPSS version 14.0 (SPSS Inc., Chicago, IL, USA).

Results

There were a total of 25 patients with 26 complications (14.1%) in 185 procedures, with 4 major and 22 minor complications. The complications were intraoperative in 10 and postoperative in 16 (Table 2). Access-related complications occurred in 5 patients. The most common intraoperative complication was vascular injury, with 5 (2.7%) cases in total (Table 3).

Table 2. Total complications of transperitoneal laparoscopy by procedures

	Patients, *n*	Complication rate by ASA, %		Mean length of postoperative stay without/with complications, d		Complications by classification, *n* (%)				
		ASA 1 or 2	ASA 3 or 4	Without	With	Intraop	Postop	Total	Minor	Major
Radical nephrectomy	36	17.6	13.3	6.5±2	10.1±7.7	5 (13.9)	3 (8.3)	8 (22.2)	8 (22.2)	0 (0)
Adrenalectomy	28	0	0	5.6±3.1	–	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Nephroureterectomy	28	5.6	42.9	8.6±3.4	12.6±7.3	1 (3.6)	4 (14.3)	5 (17.9)	4 (14.3)	1 (3.6)
Radical prostatectomy	22	21.1	0	9.4±2.6	19.6±20.2	2 (9.1)	2 (9.1)	4 (18.2)	2 (9.1)	2 (9.1)
Ureterolithotomy	17	0	0	5±1.8	–	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Partial nephrectomy	17	9.1	0	6.5±2.6	59.6±74	1 (5.9)	2 (11.8)	3 (17.6)	2 (11.8)	1 (5.9)
Simple nephrectomy	11	0	0	11.8±14.6	–	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Donor nephrectomy	6	50	0	6.3±0.5	12.3±5	1 (16.7)	2 (33.3)	3 (50)	3 (50)	0 (0)
Radical cystectomy	6	33.3	0	20.5±10.3	25	0 (0)	2 (33.3)	2 (33.3)	2 (33.3)	0 (0)
Pyeloplasty	5	20	0	5.2±1.2	11±4.2	0 (0)	1 (20)	1 (20)	1 (20)	0 (0)
Others	9	0	0	5.8±4.3	–	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Overall	185	12.8	11.8	7.4±5.5	18.6±27.3	10 (5.4)	16 (8.6)	26 (14.1)	22 (11.9)	4 (2.2)

ASA = American Society of Anesthesiologists; Intraop = intraoperative; Postop = postoperative.

Table 3. Overall incidence of complication by type

Complication	*n* (%)
Intraoperative	10 (5.4)
Vascular injury	5 (2.7)
Air embolism*	1 (0.5)
Bowel injury	1 (0.5)
Punctured liver injury*	1 (0.5)
Bag/endo sheath rupture*	2 (1.1)
Postoperative	16 (8.6)
Wound infection	4 (2.2)
Neurologic injury	3 (1.6)
Vascular injury	3 (1.6)
Urine leakage	2 (1.1)
Chyle leakage	2 (1.1)
Compartment syndrome	1 (0.5)
Ventral hernia*	1 (0.5)
Total	26 (14.1)

**Access-related complications.*

Major complications

Major complications occurred in 4 cases. The mortality rate was 0%. One patient died of pneumonia with respiratory failure due to hypoglycemic consciousness change after going home from uncomplicated laparoscopic nephroureterectomy. The cause of death was not related to the operation and not counted as a complication. The open conversion rate was 0.54% (1 patient). This patient was our first laparoscopic radical prostatectomy case and was converted to open surgery due to bleeding and failure to progress the surgical procedure. Air embolism occurred in 1 patient. This patient had ruptured renal angiomyolipoma (AML) and received scheduled laparoscopic partial nephrectomy. Oxygen desaturation occurred 30 minutes after creation of the pneumoperitoneum. The operation was cancelled and she had quadriplegia and stayed in the intensive care unit for 16 days. She recovered gradually through rehabilitation. Rupture of AML twice with embolization control resulted in prolonged hospitalization. Re-operation occurred twice (1.08%). One was for check bleeding after laparoscopic nephroureterectomy. The other was fasciotomy for bilateral lower leg compartment syndrome after prolonged dorsal lithotomy position in our second laparoscopic radical prostatectomy.

Access-related complications

This type of complication is specific for laparoscopy, and there were 1 major and 4 minor complications. The major complication was the air embolism already described above. One puncture injury over the left lobe of the liver was noted during insertion of the

Veress needle. The wound was shallow and checked with electrocautery immediately. No delayed bleeding was noted. One patient suffered from ventral hernia over the morcellation wound 2 years after right radical nephrectomy. Laparoscopic repair of the 2 × 2-cm peritoneal defect was done smoothly. One tissue bag rupture was noted during morcellation of a kidney using ring forceps. The tumor was determined to be AML by imaging, so we used an ordinary tissue bag instead of a double-layered nylon bag. The scattered tissue was retrieved as completely as possible. Pathology showed renal cell carcinoma, chromophobe type. The patient recovered smoothly. One port sheath rupture was noted in nephroureterectomy. The small piece was not found.

Vascular injuries: intraoperative events and management

Of the 5 intraoperative vascular complications, 2 were minor vascular injury by overshooting injury and controlled with electrocautery immediately. The other 3 were massive bleeding (blood losses of 3,200 mL, 1,500 mL and 1,400 mL, respectively). The first case was our open conversion case described above. The second was a donor nephrectomy case, and misfiring of Endo-TA over the Hem-o-lock of the renal artery caused massive bleeding. The bleeder was compressed and controlled with Endo Clip first and secured with Hem-o-lock after. The third was a radical nephrectomy case with active bleeding from the suprarenal region. We converted to hand-assisted laparoscopy and used Endo Clip and Endo-GIA to control bleeding.

Related factors

No statistically significant differences were found in complication rates between groups stratified by age, BMI or ASA score ($p = 0.353$, 0.093 and 0.562, respectively). The incidence of complications was related to the operative difficulties. As a matter of fact, procedures with difficulty score below *fairly difficult* had no complications (Table 4). Due to the complication rate being 0% in the *fairly difficult*, *slightly difficult* and *easy* groups, we grouped them together with *difficult*. Logistic regression showed statistically significant differences compared with the *very difficult* group ($p = 0.013$; odds ratio, 3.8; 95% confidence interval, 1.3–11.0) and the *extremely difficult* group ($p = 0.010$; odds ratio, 4.5; 95% confidence interval, 1.4–14.2). Multiple logistic regression analysis adjusted for age, BMI and ASA score still showed statistically significant difference in difficulty ($p = 0.025$, 0.012).

Discussion

Laparoscopic surgery has advantages of lower morbidity, less postoperative pain, shorter hospital stay and better cosmetic results. To obtain a good result, however, a period of learning curve is required and generally, longer operation time and higher risk of complications occur in between.[3,4] The current study represents our experience of transformation of retroperitoneal and hand-assisted laparoscopy to pure transperitoneal laparoscopy.

In the literature, early reports of complication rates were around 4.4–7.98%.[5–7] These reports represented the experience of pioneering surgeons with most laparoscopic urologic procedures considered relatively basic today (adrenalectomy, lymphadenectomy, pyeloplasty and varicocelectomy). As operative difficulty progressed, the rate of complications increased to 11.9–22.1%.[8–11] In the latest report, Permpongkosol et al reported a 22.1% complication rate in procedures 100% ranked as difficult by the European Scoring System.[11]

In the current study, the overall complication rate was 14.1%, with a 0% mortality rate and 1.08% re-operation rate. These results are compatible with the report of Parsons et al (13.2% complication rate, 0.2% mortality, 1.5% re-operation).[10] They had 73% of cases that were rated above *difficult*, while we had 70%. Showing strong relation of complication with surgical

Table 4. Incidence of complications in relation to difficulty of the laparoscopic procedures

Difficulty score	Procedures, *n* (%)	Complications, *n*	Complication rate, %
Extremely difficult	34 (18.4)	9	23.5
Very difficult	53 (28.6)	11	20.8
Difficult	39 (21.1)	6	17.9
Fairly difficult	33 (17.8)	0	0
Slightly difficult	20 (10.8)	0	0
Easy	2 (1.1)	0	0
Total	185	26	14.1

difficulty, all of our complications occurred in difficult cases. Although the complication rate was high in difficult cases, most of the complications were minor and had no long-term sequelae. Three in 4 major complications happened in the first 50 cases of the series.

Complications specific for laparoscopy were highlighted in our report. Carbon dioxide embolism was a rare (0.1%) but life-threatening complication. Knowing the normal physical change of pneumoperitoneum and close monitoring of critical clinical data related to it by both the surgeon and anesthesiologist will help to prevent such a complication.[2,12] In prevention of ventral hernia at the trocar site, suturing the fascia under laparoscopic vision is the safest choice. If the fascia is not sutured in the closure of the access points of the trocars, hernias can result from 10-mm wounds.[6] Choosing and handling the laparoscopic equipment such as tissue bag and port sheath should be done more gently and carefully to avoid the rupture of equipment.

In this study, the impact of age, BMI and ASA score on complications had no statistically significant difference. The result is different from that of Parsons et al[10] and Permpongkosol et al.[11] They reported the ASA score being strongly correlated with the complication rate. Several factors limited the results of our series. First, the data were retrospectively collected. Second, the diversity of surgical procedures and huge influence of surgical difficulty may obscure the small impact of ASA score on the complication rate. Third, our case number may not be large enough to show the statistical difference.

In conclusion, the complications of laparoscopic urologic surgeries are strongly correlated with the operative difficulties. In spite of elevated complication rates in difficult surgeries, the major complication rates were very low. As the laparoscopic surgeries in urology involve more and more technique-dependent difficult fields, documentation and analysis of experience of complications is important for the development of this surgical modality.

References

1. Clayman RV, Kavoussi LR, Soper NJ, Dierks SM, Merety KS, Darcy MD, Long SR, et al. Laparoscopic nephrectomy. *N Engl J Med* 1991;324:1370.
2. Doublet JD, Janetschek G, Joyce A, Mandressi A, Rassweiller J, Tolley D. *European Association of Urology Guidelines On Laparoscopy*. Arnhem, The Netherlands: European Association of Urology, 2002.
3. Wang PH, Liu CH, Yuan CC. Immediate repair of intestinal injury during laparoscopically assisted vaginal hysterectomy. *J Chin Med Assoc* 2000;63:148–52.
4. Chen WS, Tzeng KH, Leu SY, Hsu H. The application of laparoscopy in colorectal surgery: a preliminary report of twelve cases. *J Chin Med Assoc* 1994;53:357–62.
5. Gomella LG, Abdel-Meguid TA, Lotfi MA, Hirsch IH, Albala D, Manyak M, Kozminski M. Laparoscopic urologic surgery outcome assessment. *J Laparoendosc Adv Surg Tech A* 1997;7:77.
6. Fahlenkamp D, Rassweiler J, Fornara P, Frede T, Loening SA. Complications of laparoscopic procedures in urology: experience with 2407 procedures at 4 German centers. *J Urol* 1999;162:765–71.
7. Soulie M, Salomon L, Seguin P, Mervant C, Mouly P, Hoznek A, Antiphon P, et al. Multi-institutional study of complications in 1085 laparoscopic urologic procedures. *Urology* 2001;58:899–903.
8. Cadeddu JA, Wolfe JS Jr, Nakada S, Chen R, Shalhav A, Bishoff JT, Hamilton B, et al. Complications of laparoscopic procedures after concentrated training in urological laparoscopy. *J Urol* 2001;166:2109–11.
9. Vallancien G, Cathelineau X, Baumert H, Doublet JD, Guillonneau B. Complications of transperitoneal laparoscopic surgery in urology: review of 1311 procedures at a single center. *J Urol* 2002;168:23–6.
10. Parsons JK, Varkarakis I, Rha KH, Jarrett TW, Pinto PA, Kavoussi LR. Complications of abdominal urologic laparoscopy: longitudinal five-year analysis. *Urology* 2004;63:27–32.
11. Permpongkosol S, Link RE, Su LM, Romero FR, Bagga HS, Pavlovich CP, Jarrett TW, et al. Complications of 2,775 urological laparoscopic procedures: 1993 to 2005. *J Urol* 2007;177:580–5.
12. Conacher ID, Soomro NA, Rix D. Anaesthesia for laparoscopic urologic surgery. *Br J Anaesth* 2004;93:859–64.